ENGINEERING NEWS.

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GEO. H. FROST, PROPRIETOR.

SATURDAY, MAY 28, 1881.

WE this week offer at *very low* prices a number of books which we wish to rid our shelves of as fast as possible. They will be offered for a short time only, as if not sold, we will send them to a second-hand book store. We may as well say here that we will not handle any more second-hand books on commission.

OWING to delay in the mails, the manuscript for the History and Statistics of American Water-Works did not reach us in time for this week's issue from Mr. Croes, who is in Indianapolis making examinations for extension and improvement of the water supply of that city.

WE have received a dozen copies of "Rawlinson's Suggestions as to Main Drainage and Water Supply," which are for sale at $2 per copy. We will have some more in about six weeks. Until then these are the only copies on sale in this country. As it is a British government publication the edition is limited, and is even now becoming exhausted. Hence a slight advance in price.

WE will be obliged if the parties who sent us volumes of ENGINEERING NEWS to bind will call or send for the bound volumes. The price for binding is $1.00, and where sent by mail thirty-five cents extra. This is the last binding that we will undertake, as the difficulties attendant upon it are too disproportionate to the profit to warrant taking any more orders.

NOW and then it may be a good plan to offer a prize for a plan for some important public work. The competition for plans for a bridge over the Rhine at Mayence, resulted in the first prize (8,000 marks) being awarded a Frankfort engineer, while three other prizes, each of 2,650 marks, were given to Berlin engineers. The engineer who won the first prize accompanied his plans with water color drawings from different points of view, and not forgetting the Grand Ducal Palace it is very likely that the pictures, everything else being equal, had their effect.

A CASE of importance to cities having a public water supply is reported as follows in the Philadelphia *Times* of the 20th inst.:

"A four-inch water main at Fifteenth and Cuthbert streets burst at an early hour on the morning of November 26, 1880, and damaged $300 worth of tobacco which had been stored in the basement of Frank Zimmerman's tobacco factory, on the corner. He sued the city, and the case was tried before Judge Ludlow yesterday. It was in evidence that the pipe was laid forty years ago, and counsel argued that the city was liable for damages done by a pipe of that age, it being its duty to inspect them. City Solicitor West argued for a non-suit, contending that as the defect was a latent one the city was not supposed to anticipate that such breaks would occur, and to hold otherwise would require the city to go to vast expense and dig up all pipes under the apprehension that they might possibly break and do damage. Judge Ludlow granted the non-suit."

A HOUSE-OWNER, in front of whose house in West Twenty-first street, this city, the Metropolitan Telephone and Telegraph Company has erected a pole, brought suit for an injunction to restrain the company from putting up its poles. Soon after suit was begun a question arose as to the right of an ordinary citizen to maintain such an action. Mr. L. E. Chittenden, attorney for the house-owner, then applied to the Attorney-General for permission to sue in the name of the people of the State. Having procured the desired permission, Mr. Chittenden brought the new suit, and obtained another injunction from Judge Donohue, in Supreme Court Chambers. The complaint in the action of the People against the Metropolitan Telephone and Telegraph Company avers that Twenty-first street is desirable for private residences; that houses in it have commanded high rentals, which will be diminished if obstructions are put in it; that the public have the right to its use unrestricted by such obstructions as telegraph poles; that the erection of such poles with cross-bars, wires, etc., imperils life and limb, and is in violation of law; and that there is no authority whatever for the erection of poles to sustain wires for telephonic communication in this city. The order to show cause why the temporary injunction shall not be continued is returnable in Supreme Court Chambers, on Monday, May 30.

STILLWATER, Minnesota, the third city in size in that State, having completed its water-works, is now moving for a system of sewerage. The city is situated on Lake St. Croix; has a population of about 11,000; is the centre of a great lumbering and milling business; has the State Penitentiary located there; is growing rapidly, has fine streets and buildings, and a most enterprising class of citizens. The city council has employed D. W. Cunningham, Civil Engineer, of Boston, Mass., to make the necessary surveys and plan a system of drainage and sewerage for their city. Mr. Cunningham is now engaged upon that work, and writes us that "the difficult part of the problem is the drainage from steep side hills and sandy ravines, which during heavy summer rains discharge torrents of water and sand into the heart of the main streets, the grades of which have been established without regard to drainage facilities, *the* main street being only two or three feet above high water in the lake, which varies about twenty feet from high to low water. If the grade of the main street is raised sufficient to give good drainage, the fine new opera house and blocks of stone and brick buildings will have to follow; if it is not raised, pumping for a limited area must be resorted to. Private enterprise is at work washing down sand hills to fill up ravines and grade streets by means of water jets from the Water Company's gravitation works."

We suggest to Mr. Cunningham a comparison of notes with Mr. Chesbrough, of Chicago. When confronted with the problem of draining Chicago, some twenty-five years ago, it was either raise the city or pump. The latter would be a perpetual tax upon all the people; to raise a portion of the city would be a temporary expense. The City Council raised the city, but did not order it high enough lest the popular feeling should defeat it; the consequence was the raising process had to be repeated, and still again when the fire of 1871 conveniently razed the business portion, the grade was again elevated. It was a case of "timid" engineering, but was probably the only alternative, as the engineer fully understood the necessities of the situation. Mr. Cunningham will find opposition from the owners of buildings to a plan of raising the grade, but ten years hence they will require it to be done, when the expense will be much greater than at present.

THE CONVENTION.

If there is an association in this favored land of ours that knows how to plan pleasure excursions to better effect than the American Society of Civil Engineers, through its Executive Committee, then we are not acquainted with that much-to-be-envied body. Within the past five years the civil engineers have traversed a very respectable portion of the continent, always under the most favorable conditions for combining a great deal of pleasure with a very great deal of intellectual profit. They have angled for eyeless fish in the crystal waters of the Mammoth Cave, with Charon to cut bait, wandered amid orange groves, and plucked magnolia blossoms on the lower Mississippi; investigated the apparatus, and watched the method of operating on the mouth of the Father of Waters by the great dentist Dr. J. B. Eads; bought cheap bouquets and black coffee in the French market, and looked wise over the guages and things that, in New Orleans and other southern river cities, overshadow such trifles as good water and efficient sewerage. Then they were put through on the "Boston plan," and having seen the clean streets, the clean reformatories, the clean and lovely suburbs, and the clean water of Cochituate, to say nothing of the "awfully awful" strong lemonade served out only in Boston, they were taken to the pinnacle of a high mountain (according to the revised edition) and to several other mountains, and, as far as the sleet and rain and such like pleasantries of a New Hampshire climate would allow, permitted to overlook the broad domain that is considered the special property of the modern Athens. What engineer does not remember Euclid avenue, the funereal hack procession, the miles of weary travel through screw factories, steel mills, rolling mills, cooper shops and oil store-rooms, the lightning barrel painters in the Standard Oil Company's warehouse, the big viaduct, etc., of Cleveland; the fast trains, the broad prairies, the great rivers and their bridges, St. Louis, its mud and heat; Pilot Knob, the glass works and the marvelous railway to them; Plattsmouth, etc., of last year. Then who can estimate the miles of rolling mills and factories these patient and pleasure-seeking pilgrims have promenaded through; the mines and quarries they have explored, the bridges and towers they have climbed through and ascended, the sewer systems they have smelled, the thousand and one other objects of interest and instruction that have been exhibited to them in the past years, the sum total of which must possess an educational value that can not be computed. The men who go on these yearly excursions are men of rare intelligence, who know the value of the exceptional privileges with which they are favored and whom it is a privilege to entertain. This year's programme is somewhat of a departure from the past. What committee could plan a more alluring holiday excursion than Niagara Falls, Toronto, Lake Ontario, the noble St. Lawrence, with its variety of scenery, the island studded lakes, the broad river of crystal water, and the swift rapids, that are a never ending source of pleasure to the tourist; then the Canadian cities, Montreal, Ottawa, Quebec, the quaint people of the lower province, the habits and customs of a people who are so near to the "live Yankee" nation as regards locality, but yet who are so thoroughly foreign in thought and action. Every Member who can take the time should go to the Convention this year. The opportunity for making new and valuable acquaintances will be unexcelled; the trip will be one of unwearying interest, the papers to be discussed are of great professional value, and the recreation cannot fail to benefit.

PERSONAL.

Capt. T. S. Anderson, who has been chief engineer of the levees in Mississippi for the past six years, has recently been appointed chief engineer also of the Greenville, Columbus & Birmingham Railroad.

D. C. Jenne, formerly Resident Engineer Hennepin Canal Improvement, has accepted the position

of Treasurer and General Manager of the Brazil Block Coal Company, and may be addressed at Brazil, Indiana.

At a meeting of the Indianapolis (Ind.) Common Council on May 17, the resignation of R. M. Patterson, City Civil Engineer, was accepted, and Samuel H. Shearer was elected to fill the vacancy, from June 1 to December 31, 1881.

At the Civil Engineers Club (of Cleveland) meeting, held on Tuesday evening last, Mr. J. E. Turk was proposed for membership, and Messrs. H. E. Dunham and N. B. Wood were elected members. After an interesting discussion a committee, composed of Mr. C. Latimer, Col. J. M. Wilson, Messrs. J. D. Crehore and M. E. Rawson, was appointed to examine as to the advisability of procuring permanent marks to serve as a public bench mark, and a standard measurement for a surveying chain of one hundred feet in length, the committee to report at a future meeting.

The following is the Sinaloa & Durango Railroad Engineer Corps, sailing by P. M. S. S. Colon, May 21st: Thos. H. Loomis, Principal Assistant Engineer; Jas. B. Van Buren, Office Assistant; Jno. M. Rudiger, Jr., Topographer; Louis J. Davids, Transitman; J. G. L. Doughty, Leveler; J. L. Fitzgerald, Wm. Gray, Wm. T. Griswold, Wm. B. Landreth, H. M. Wilson, assistants; Chas. L. Pruden, Master Carpenter; Frank Furlong, John Stevens, John Guth, Carpenters; Wm. K. Stout, Blacksmith.

This party goes *via* the Isthmus to Altata, 150 miles north of Mazatlan, on the Gulf of California, whence the line runs eastwardly and inland, through Culiacan to Durango, where it connects with the Mexican Central. Mr. Edward P. North, Chief Engineer, left on Friday, the 13th, for Vera Cruz, whence he goes overland *via* City of Mexico and Durango to Altata. Headquarters of the party will be at Culiacan.

THE NEW YORK AND BROOKLYN BRIDGE.

(*Continued from page* 202.)

FILLING UP THE AIR-CHAMBER.

Concrete was laid at the rate of one hundred yards per day of sixteen hours, but as the space became more contracted this quantity was reduced. A great saving in time as well as amount of concrete was effected by letting the edges of the caisson sink into the ground three and one-half feet deeper than the average level of the bottom. This diminished the amount to be filled about one-third.

The concrete consisted of one part Rosendale cement, two of sand, and four of small-sized gravel. The sand and cement were mixed above and passed through one shaft, the gravel through the other. The boulders which had been taken out of the caisson were broken up into square blocks, and again built in below with the concrete. The general mode pursued in the filling was to build narrow bulkheads from three to four feet wide from the floor to the roof all around, the sides being kept vertical by boards which were removed after the concrete had hardened. Next to the roof a shallow, sloping layer was rammed in with a narrow, flat-faced iron rammer. As this was the most important point in all the filling, and was apt to be slighted, it required the most careful watching. Each layer of concrete was allowed to remain for five hours before another was put on. The total quantity required was about 4,000 yards, including the brick piers.

The rapid influx of fresh water from springs prevented any material reduction of the air pressure. The water shafts were cut away below and filled up with concrete to the line of the roof. After the cavity had been filled, and the air pressure removed, it was found that sufficient water leaked through the concrete to fill the shafts to the top. They were then filled from above with concrete, lowered to the bottom in self-dumping buckets. The water rising in the shafts was perfectly fresh, without a trace of salt, which showed that the timbers would ultimately be saturated with fresh water. Its temperature was remarkably high—70 degrees—whereas, that of pure spring water is 55 degrees, and of the river 50 degrees. This would indicate that the whole mass of timber and concrete must have been heated to the temperature existing in the air-chamber, which averaged from 70 to 80 degrees throughout the winter, and was even greater up in the timber where all the hot air was concentrated. It is also probable that the water penetrating the concrete as soon as the air pressure ceased would produce some heat by contact with the small quantity of free lime there existing. The concrete filling was permeated by air throughout, and even when the last charge was put in the air bubbled up under the edges of the caisson, requiring a passage of 50 ft. through the concrete.

FIRES.

The danger from fire in an atmosphere of compressed air is very serious, and becomes doubly so, with a wooden caisson penetrating a water-tight stratum. Even at a pressure of 25 pounds per square inch the flame of a candle will return when blown out and all inflammable materials have to be banished. Several minor fires at the beginning showed the necessity of caution. One was of sufficient magnitude to demand the flooding of the caisson, which was then easily accomplished as the water entered freely under the shoe, as the air escaped through valves provided for that purpose. When, therefore, the fact was settled that the river water was permanently excluded from the caisson, it became a matter of primary importance to guard against fires, and accordingly two hose connections were provided, throwing streams of one and one-half inches at 65 pounds pressure. Steam pipes were introduced connected with boilers outside. In addition, all seams between the roof timbers were carefully pointed with cement, and iron shields were placed over the permanent lights. It was made the special duty of two men to watch continually over all lights. Notwithstanding all there precautions, there was a seam where the supporting frames joined the roof that had not been pointed; an empty candle-box was nailed under it, in which some man kept his dinner, and while getting it he probably held a candle against the roof for some time. At this place a fire was discovered on the evening of Dec. 3. Being directly over the frame, it had remained undiscovered until the latter had been partially burnt through, and, judging from the headway attained, it had been burning for some hours. A slight stampede ensued among the men, but no one left the caisson. All appliances for putting it out were brought to bear. While the hose was getting ready, two large cylinders of carbonic acid gas, under a pressure of 225 pounds, were discharged into it without producing any effect whatever. As soon as the stream was stopped the timber would reignite immediately. The two streams of water soon extinguished all fire that could be seen. There was a violent draft of air through the aperture; this was stopped with cement, and the streams kept playing for two hours. At the end of that time one of them was replaced by steam at 90 pounds pressure and allowed to run for half an hour; but it could not be ascertained if this was of any benefit, and the water was again turned on.

In the meantime, the question of flooding the caisson was seriously discussed. To extinguish the fire without having recourse to this resort was very desirable; yet, on the other hand, if the fire was not out, it was simply a question of time when the entire structure would be destroyed.

The problem to be asked in the flooding was to substitute the compressed air by the water poured in through the water shafts from above, and to so regulate the escape of air as to always maintain the same pressure against the roof of the caisson, even up to the last inch below the roof, until the water had entirely replaced the air. The supply of the former would, of course, be limited and variable, and if the air should be all out before the water had reached the roof, the result would be a sudden drop of the caisson and the destruction of all supports by the weight of 28,000 tons, beside running the risk of causing the caisson to leak so badly as to render reinflation impossible.

The only way to ascertain the presence of fire was to bore for it at random through the solid timber; a number of holes were bored up for a distance of two feet. They showed no fire. Others were then bored up three feet, still showing no fire, a result which was, of course, encouraging. But a hole four feet high revealed the dreaded fact that the fourth course of timber was one mass of living coals.

It was at once decided to flood the caisson, and all the available engines of the fire department were soon at work pouring water into the shaft. In a comparatively short time 38 streams of water were flowing into the caissons beside the water from the pipes in the caisson itself. In about five hours the air-chamber was filled, the total amount of water required being 1,350,000 gallons.

The caisson remained flooded for two and one-half days, when the air pressure was again put on and the water forced out. An inspection below showed but little apparent damage, beyond blocks that were crushed and some posts thrown over. The building of the brick piers was resumed and completed in about two weeks, when the caisson was lowered down to them through the remaining distance of two feet.

About 200 borings were made in the roof to ascertain the extent of the fire, both laterally and vertically. It was found that it was confined to the third and fourth courses of timber, but had spread out laterally in many different directions, covering a much larger area than was anticipated, the remotest points being 50 feet apart. The fact of the air rushing out through every bore hole showed that the immediate roof must be relied on to retain the air. With this object in view it appeared advisable to inject cement into the burnt cavities through the holes until the leakage was stopped, and accordingly a cylinder was prepared with a piston and a 1¼ inch injecting pipe, and when freshly filled was placed under a hole, and the cement forced up by a screw-jack. Experiments showed that a mixture of one part of sand and one of cement could be forced a distance of 10 feet through a small pipe, and would then spread out laterally to some distance. As soon, however, as a certain moderate amount of resistance was experienced, all the water would be squeezed out, and it would be impossible to force the charge another inch. It was found that the current of escaping air through the holes would draw up the cement loosely through a pipe. When a hole became clogged a stuffer was applied to compact it. By these means 600 cubic feet of cement were injected, when the escape of air ceased.

A number of trial bore holes failed to disclose any space not filled with hard cement, but in order to make sure, one large hole, six feet square, was cut up into the roof through five courses, directly over the place where the fire originated. It was found that the cement had, indeed, filled the space, but that the timber was covered with a layer of soft and brittle charcoal varying from one to three inches in thickness. There was no alternative now but to remove all the cement and carefully scrape the charcoal from every burnt stick. As the cement was removed the full extent of the fire gradually became visible, and in place of one

opening in the timber, five were required in order to reach the remotest points. This task required 18 carpenters, day and night, for two months, in addition to common labor.

Above the first opening the fire had destroyed the third, fourth and fifth courses, having burned through the tin that lies between the fourth and fifth, and also one or two cubic feet of the sixth course. In this latter course the timbers are laid three inches apart with concrete between. This concrete checked all further spread of the fire in the sixth course, and in every other spot except above the large opening the tin had acted as an effective barrier. The various ramifications of the fire had evidently been caused by air leaks. The general combustion was of the nature of a slow charring, progressing equally in all directions. Whenever a stick was only partially consumed it was carefully scraped and the cavity rammed full of cement. The larger spaces were filled up with yellow pine forced in with screw-jacks and wedges, in lengths of from eight to ten feet, and well bolted vertically and laterally. After everything was filled up solid, a number of five-foot bolts were driven up from below so as to unite both the old and new timber into a compact body. Forty iron straps of four by three-quarter inch iron were bolted against the roof from below, so as to balance the break of bond in the fourth course, and, finally, in order to further prevent any undue settling over the line of fire, the space beneath in the air-chamber was built entirely of square blocks of trap rock, carefully laid in cement, in place of the gravel concrete which filled the rest of the chamber.

ORGANIZATION OF WORKING FORCE.

Each shift of men worked in the caisson eight hours at a time; the first watch from 6 a.m. to 3 p. m., including one hour for breakfast; the next from 3 p. m. to 11 p. m., including one hour for supper; then a special night-gang from 11 p. m. to 6 a. m.

The two day-shifts alternated from week to week; they consisted of one general foreman, six assistants, 112 laborers. The night-gang was composed of one foreman, two assistants and 40 laborers.

On deck there were double shifts of engineers and firemen to run the excavating engines, and engines for running the dirt-cars, also two gangs for attending to the dumping of the latter. In addition there were the engineers for the air-compressors and stone-hoisting engine, blacksmiths, machinists and gas men, one gang to remove the boulders brought up by the buckets; a carpenter's force of 25 men and 30 men for setting masonry.

The total daily force amounted in all to 360 men.

In changing shifts the old gang always remained in the caisson until relieved by the new one.

DOCK.

During the winter months of 1870–71, the dock resting on top of the caisson, on the river side, was completed, filled in, and provided with a track, turn-tables and unloading derrick. On the land side the excavation was filled in up to the masonry.

When the caisson proper had been filled in the locks were removed, the water-shaft filled and the sections above the timber taken out. Next, the coffer dams inside the masonry well-holes were removed and the mud taken out. No water leaked through the masonry, but considerable fresh spring water oozed up through the timber foundation that was easily kept in check by pumps. These well-holes were filled with concrete for a height of 25 feet, requiring 550 cubic yards. For the remainder of the distance, up to the floor line of the bridge, these well-holes remain open, so as to save masonry in the tower.

THE NEW YORK CAISSON.

Having described, quite at length, the operations connected with the Brooklyn caisson, we will confine our remarks upon this subject to noting the changes in the *modus operandi* which that experience rendered advisable.

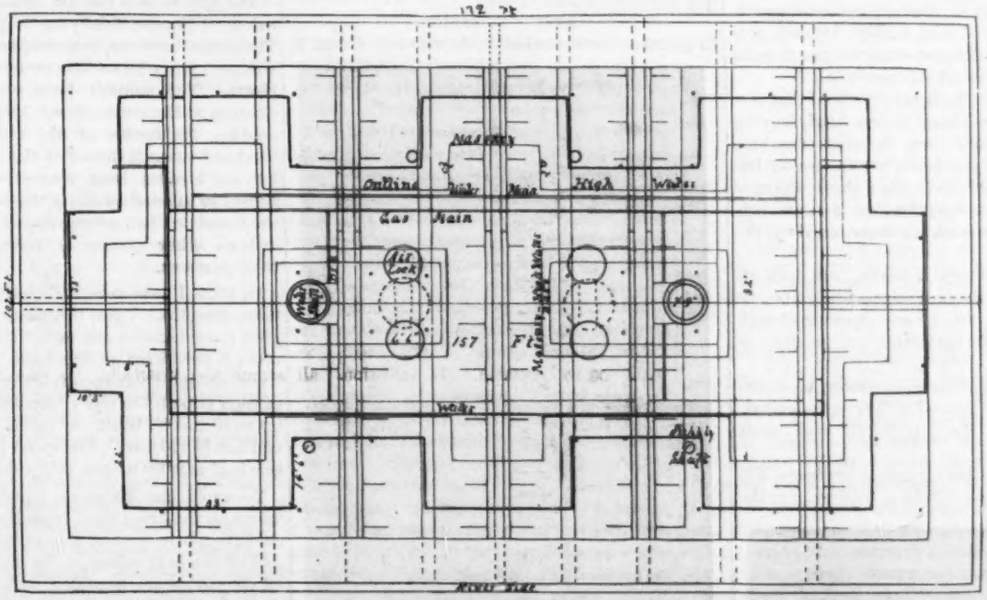
THE FOUNDATION.

The New York tower is located at the end of pier 29, in deep water, at a distance of 400 feet from the bulk-head line. A front of 235 feet on the pier line is taken up by the foundation itself and the inclosure of that piling. During the spring and summer of 1871 the operation of dredging a level for the reception of the caisson was carried on.

Borings revealed the fact that the strata were exceedingly irregular, all more or less yielding, with extensive beds of quicksand reaching nearly to the gneiss rock, which was found at a depth of from 77 to 92 feet below high tide. It was then decided that the caisson must go nearly, if not quite, to the rock.

The plans for this caisson were perfected in the summer of 1870, and a contract was made in October with Messrs. Webb & Bell, the builders of the first caisson, the iron work being done by Messrs. John Roach & Son, of the Morgan Iron Works. In its general features this caisson was a duplicate of the Brooklyn one. As it would ultimately be subjected to the pressure of a much larger mass of masonry than on the other, it was decided to increase its size to 102 by 172 feet; the air-chamber was of the same height, nine feet six inches. The roof was 22 feet thick, surmounted by a coffer dam built from the top of the twelfth course to high-water mark. By this means greater buoyancy was obtained, the pressure on the frames and other parts during sinking lessened, and the stability increased.

The air-chamber was divided into six compartments by five main frames. These compartments varied in width from 25 to 30 feet and were 102 feet in length, and subdivided by lighter secondary frames running through the middle. In addition there were two heavy cross frames extending through the whole length of the caisson. The total bearing surface was 18 per cent. of the whole base.



NEW YORK CAISSON—HORIZONTAL SECTION AT TOP OF AIR-CHAMBER.

The interior of the chamber was lined throughout with light boiler iron—No. 6 gauge—riveted together and calked. A light iron was purposely selected in order to overcome to some extent, by its buckling, the difficulty arising from the expansion and contraction of so large a surface rigidly bolted to an unyielding mass of timber; in addition, a series of expansion joints of angle iron were put in transversely to aid in taking up the contraction. The surface covered by the lining had an area of about 26,000 feet, and was pierced by 6,000 bolts. The lining performed two principal offices—that of making the chamber air tight, and that of protecting the timber against fire.

(TO BE CONTINUED.)

On Friday night, 20th, the Western Union Telegraph Company received from New York direct for the Chicago newspapers alone 109,436 words of special dispatches, 99,658 of which were parts of the revised New Testament. As no previous notice of this extra work had been given the company, and as it was in addition to the regular press and ordinary business messages, the feat is unparalleled in the annals of telegraphy, and but for the combined resources of the three former companies now under one management, it would have been an impossibility. Twenty-one direct circuits with New York were in use, and the time consumed was less than seven hours.

TRANSITION CURVES.

BY JAMES K. GEDDES.

By the term transition curve we are to understand a curve that is used for easing off a circular curve of short radius, that trains may the more easily pass from tangent to curve and *vice versa*.

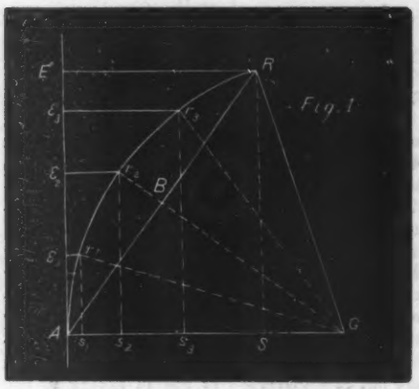
The kind of curve required for this is one having a radius which at the point of connection with the main curve is the same as that of the main curve, but which rapidly increases in length till the point when the transition curve becomes tangent to the tangent line, at which point its length is infinite. The cubical parabola is the best curve known for this want, though heretofore it has been but little used, owing to supposed complicated calculations involved, and, as a consequence, other curves have taken its place. One practice had been to use a short, simple curve at each end, with a longer radius than that of the main curve. A much better one is a circular compound curve, which, commencing at the tangent point, is, say a 1° curve for a given distance, a 2° curve for a like distance, and so on till the degree of the transition curve is the same as that of the main curve. But this cannot be used with facility without specially constructed tables, and what is more it lacks the adaptability of the cubical parabola.

The result of the whole matter has been that few engineers attempt anything of the kind, leaving the trackmen to bungle over the matter as best they can. Nearly all trackmen try to ease off the curve by setting in the rails for a short distance back, which, however objectionable, is much better than to leave the track as determined by the engineer.

With these introductory remarks, we shall attempt to show how the cubical parabola may be used as a transition curve, by any engineer of ordinary ability, without involving any lengthy or difficult calculations.

First, it is necessary for the engineer to determine what length of transition curve is desired, which depends upon the topography and other circumstances.

Then we determine the tangental ordinate ER (Fig. 1) and the abscissas AE, $A\varepsilon_1$, $A\varepsilon_2$, etc., for the



main or circular curve for a chord AR, half the length of that of the required transition curve. To do this proceed thus:

Having given the radius AC and the half chord AB, we may find the angle ACB from the formula, $sin.\ ACB = sin.\ RAE = \frac{AB}{AC}$. We may then find the ordinate ER from the formula $ER = AR \times sin.\ RAE$, and the abscissa, AE, from the formula $AE = RC \times sin.\ RCA$. For the other abscissas we have:

$$A\varepsilon_1 = r_1\,C \times sin.\ r_1\,CA.$$
$$A\varepsilon_2 = r_2\,C \times sin.\ r_2\,CA.$$
$$A\varepsilon_3 = r_3\,C \times sin.\ r_3\,CA.$$

Having thus determined the ordinate ER and the abscissas $A\varepsilon_1$, $A\varepsilon_2$, etc., for the circular arc, we may derive those for a cubical parabola as a transition curve from these values. Thus (in Fig. 2) we have

$$PV = 2\,AE \qquad Pv_1 = 2\,A\varepsilon_1$$
$$Pv_2 = 2\,A\varepsilon_2 \qquad Pv_3 = 2\,A\varepsilon_3$$

We have the ordinate $VR = ER + \frac{ER}{3}$.

Any other ordinate may be found, by dividing the value found for VR by the cube of the number of stations, and multiplying the quotient by the cube of the number of the station, commencing at P.

Example: Let it be required to use a transition curve of 100 ft. for a 11° curve, the length of the stations for the transition curve being 25 ft.

We have (Fig. 1), $sin.\ ACB = sin.\ RAE = \frac{25}{521.67} = .047942$, corresponding to which we have the angle

$2°\ 44'\ 52''$

$$ER = .047942 \times 50 = 2.397$$
$$AE = 521.67 \times sin.\ (2°\ 44'\ 52'')\ 4 = 49.9595$$
$$A\varepsilon_1 = 521.67 \times sin.\ \left(\frac{2°\ 44'\ 52''}{2}\right) = 12.51$$
$$A\varepsilon_2 = 521.67 \times sin.\ 2°\ 44'\ 52'' = 25.01$$
$$A\varepsilon_3 = 521.67 \times sin.\ (2°\ 44'\ 52'')\ \tfrac{3}{2} = 37.49.$$

Then for the abscissa PV (Fig. 2), for the transition curve we have

$$49.9595 \times 2 = 99.9190.$$

In practice, to determine the location of P and V,

lay off 49.9595 on each side of P_2, the original tangent point:

We have for Pv_1, $12.51 \times 2 = 25.02$
for Pv_2, $25.01 \times 2 = 50.02$
for Pv_3, $37.49 \times 2 = 74.98$.

$$\text{The ordinate } VR = \left(2.397 \times \frac{2.397}{3}\right) = 3.196.$$

$$\text{Then we have for } v_1\,a_1,\ \frac{3.196}{4^3} \times 1^3 = 0.05,$$
$$\text{for } v_2\,a_2,\ \frac{3.196}{4^3} \times 2^3 = 0.41,$$
$$\text{for } v_3\,a_3,\ \frac{3.196}{4^3} \times 3^3 = 1.38.$$

From the above it will be observed that the stations are not exactly 25 ft. apart, the abscissa Pv_1 being 25.02, and Pv_2 50.02. Nor is a chord drawn from P to R exactly 100 ft. long, but 99.97; but these errors are too small to take into account in ordinary railway practice. However, when it may be desirable to take into account the error in length for the chord PR, the chord may be readily found from the formula,

$$PR = \sqrt{\overline{PV}^2 \times \overline{VR}^2}.$$

Having thus determined the points for the transition curve, we may begin laying out the main curve as usual from the offsetted tangent AE, distant from v_2 $\frac{2.397}{3} = .799$.

In conclusion, it may be remarked that the above method of using the cubical parabola for transition curves may be employed with much more ease when tangental abscissas and ordinates are used for laying out the main curve, as in *Kröhnke's Handbuch zum Absticken von Curven*, where we have already given the abscissas and ordinates for any required circular curve.

HAZELHURST, Miss., May 15, 1881.

CABLE TOWING ON CANALS.

The following notes upon cable towing on canals and rivers may be of interest at this time.

The system is in use on some portions of the canals of France, chiefly for the passage of tunnels. The chain, however, is generally used in France, although the wire cable is preferred on the Belgian rivers. The summit level of the canal Saint Quentin at Riqueval, about 12½ miles long, including the tunnel of 8¾ miles; the summit level and summit tunnel of the Burgundy Canal, 3.8 and 2 miles long respectively; and a short tunnel 10 kilometers above the Belgian frontier on the Canal de l'Est, are navigated in this manner, and no other system of traction is in use over these portions.

Of these I have personally only visited the Canal Saint Quentin. Upon this there is no interference with horse-boats or any other system, because no other is permitted on the level. Two large tow-boats make regular trips from end to end, taking at each trip all the boats that are ready to move, up to 20 and 30 boats at times. Boats carry 200 and rarely 270 tons. The speed in the tunnel with this load is 2,000 meters (1¼ miles) per hour.

To avoid the difficulty which, it is said, has arisen on the Erie Canal, from the tendency of the chain to move toward the convex side on curves, and of the boat to run on the slope on that side, all the curves are provided with *glissières* frames of timber extending into the canal as far as the foot of the slope, against which the boat slides in its passage around the curve.

On the wider curves of the rivers these are not needed. Upon the Seine, I believe, the towing chain is now displaced. The German engineers, against less cost, less friction, and smooth running of the wire rope, make the objection that it is more easily displaced and more difficult of repair.

An interesting paper has just been published by Professor Teichmann, of Stuttgart,* on the relative cost of towing with paddle-wheel or propeller tugs, and with tow-boats on submerged cable. Although the larger engines of the former are compound engines, built with great care, and with a view to economy in working, and burn but 0.8 as much coal per indicated horse-power as the more common engines of the cable tow-boats, yet the consumption of coal by the latter per unit of work done is less than one-fourth of that used by the paddle-wheel boats.

But the main question there is the renewal of the essential organ, the chain (or the cable). As to their relative merits, the chain is more flexible, and permits the use of winding drums of less diameter, and therefore less complicate gearings, and may be placed in the axis of the boat. The chains being heavier, lifts from the bottom at a

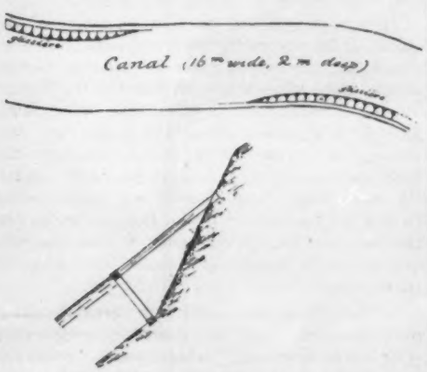
*Quoted in the "Chronique" of the Société des Ingenieurs Civils, 1881.

much shorter distance from the boat and less liable to be displaced in the bed of the river. But the friction on the drums and the numerous rollers is considerable.

The cable is less pliable and requires sheaves of great diameter, which in most tow-boats must be placed on the side. An exception, the tow boats of the Neva, may be cited, on the Ziebarth system, with horizontal pulleys, and three tow-boats on the lower Rhine; these last cannot be detached from the cable without cutting it.

The cable being lighter, lifts farther from the boat, and is easily displaced in the bed of the river, the movement of the machinery is smoother and the wear is less, although the friction of the double quantity of gearing must be considered. The principal advantage is in first cost.

Besides the tensions due to traction, the abnormal strains must be considered. Those which are produced partly by the sudden movement of the boats towed, chiefly on curves, and in part by the unequal diameter of the grooves in the pulleys,



caused by wear. Although strong chains are used, breaks are not rare, and there is one place above Dresden where a mended link can be seen every 50 or 60 meters.

With the cable breaks are rare. Between Oberkassel and Bingen, where the current is very strong, there was no break the first year, in the second 2, in the third year 7, in the fourth 15. As a mean there has been one break for 91 passages. The breaks are more difficult to repair, and the repair creates an enlargement of diameter at the place. The cables are also liable to be injured or cut by sharp rocks.

The comparisons and calculations given show that economy of the tow-boat with cable, over the tug, increases as the current is stronger, and that when the velocity is reached against which the latter is not able to go forward the latter can still do work, W. R. HUTTON.

BALTIMORE, May 20.

CORRESPONDENCE.

U. S. COAST SURVEY PUBLICATIONS.

NAPANEE, May 20, 1881.

EDITOR ENGINEERING NEWS:

Can you tell us where we can obtain the papers of the U. S. Coast Survey, relating more particularly to geodetical operations, and oblige?

SEVERAL SUBSCRIBERS.

ANSWER.—At the office of the U. S. Coast Survey, Washington, D. C.

ANSWER TO "AQUARIUS."

U. S. ENGINEER OFFICE,
CINCINNATI, O., May 21, 1881.

EDITOR ENGINEERING NEWS:

The following is my solution of "Aquarius' Hydrostatic Problem" in your paper of May 7.

Amount of water discharged—in length of column of the pipe, 4.2066 ft.

The height of water in the several branches of the pipe will be as follows with respect to the line *FG*:

A 3 ft. below line *FG*
B 1.2066 ft. " " "
C 0.8967 ft. above " "
D 0.8967 ft. below " "

The following are the general formulas of the solution:

$$x = \frac{3h + 2a + 2d}{12} \pm \sqrt{-\frac{hd}{6} + \left(\frac{3h + 2a + 2d}{12}\right)^2}$$

$$y = d - 2x$$

In the above formulas

x = the height above line *FG* to which the water will rise in branch *C*, and also the corresponding depression in branch *D*.

y = depression in branch *B*.

a = length of inclosed air space.

d = distance of opening *E* below line *FG*.

h = height of a column of water which would be supported by the atmospheric pressure at time of experiment.

In the numerical solution given h has been assumed = 34 feet. H. L. S.

ANSWER TO "AQUARIUS."

NEVADA CITY, Cal., May 17, 1881.

EDITOR ENGINEERING NEWS:

The answer to problem in issue of May 7 is: 4.206 ft. in length of column of pipe will be discharged and the position of surface relative to *FG* will be, in pipe *A*, 3ft. below, in *B* 1.206 below, in *C* 0.897 above, and in *D* 0.897 below *FG*, assuming atmospheric pressure equal to 34 ft. of water.

The simplest solution is got by what may be thought the unscientific method of "trials."

It is evident that in order to be in equilibrium, the surface in *A* must be at *E*, and whatever *B* is above *A*, *C* must be the same above *D*, also *C* and *D* must be equidistant from *FG*. Assume, say, 1.5 ft. for *B* above *E* and *C* above *D*. This lengthens the air-space from 5.57 to 6.32 ft., increased 1.5 ft. in *B* and lessened 0.75 ft. in *C*, indicating by Boyle's law a pressure of 29.97 ft. (6.32 : 5.57 :: 34 : 29.97), which added to the 1.5 ft. column of water, makes 31.47 ft., which is *not* in equilibrium with the 34 ft. on *A* and *D*; therefore "try" another height, say 1.8 ft. The same process applied to this height gives 34.06 ft., or nearly equilibrium, and a simple interpolation gives 1.79, which on being tested as before shows 1.794 ft. to be correct.

Then the surface in *B* is 1.794 ft. above *E* or 1.206 ft. below *FG*, and applying the formerly stated conditions 0.897 ft. above and 0.897 ft. below the same line in *C* and *D* respectively. These trial operations are very simple, as the product 5.57×34 is common to all. For most problems three times will suffice and a result can often be got quicker than by any other method. R. B. S.

AMERICAN INSTITUTE OF MINING ENGINEERS.

VIRGINIA MEETING, MAY, 1881.

The following papers have been announced:

Address by the President, Wm. Metcalf, Pittsburgh, Pa.

The Ore Knob Copper Process, by Prof. T. Egleston, New York City.

The Hydro-metallurgy of Copper and its Separation from the Precious Metals, by Dr. T. Sterry Hunt, Montreal, Canada.

The Foreign Substances in Iron and their combinations, by F. L. Kleinschmidt, St. Louis, Mo.

Notes on Gold Mill Construction, by A. J. Bowie, Jr., San Francisco, Cal.

Index to American Engineering Articles and Papers, for 1880, by Prof. H. S. Munroe, New York City.

The Geology, Mineral Resources and Industries of the Virginias, by Jed Hotchkiss, Staunton, Va.

The Practical Working of the Ammonia-Soda Process, by O. J. Heinrich, Drifton, Pa.

The New Westmoreland Shaft, by W. P. Little and T. B. Stearns, New York City.

A Volumetric Method of Estimating Manganese in Pig-iron and Steel, by F. H. Williams, St. Louis, Mo.

Filtering in Industrial Operations, by P. Barnes, Springfield, Ill.

Observations on some Ores of the Upper James River, by Prof. P. Frazer, Philadelphia.

Rich Hill Iron Ores, and the Falling Cliff Zinc Mine, by F. P. Dewey, Chattanooga, Tenn.

On the Solution of Pig-iron and Steel for the Determination of Phosphorus, by N. H. Nuhlenberg and T. M. Drown, Easton, Pa.

The Occurrence of Black-band Iron Ores in West Virginia, by S. P. Sharples, Boston, Mass.

The Electrolytic Determination of Copper and the Formation and Composition of so-called Allotropic Copper, by J. B. Mackintosh, Hoboken, N. J.

Blast-furnace Hearths and Linings, by John Birkinbine, Philadelphia.

Discussion on Steel Rails, by Rich. Akerman, of Stockholm, Sweden; C. P. Sandberg, London, and others.

THOMAS M. DROWN, Secretary.

EASTON, Pa., May 23, 1881.

ENGINEERS' CLUB OF PHILADELPHIA.

RECORD OF MEETING, MAY 21, 1881.

Vice-President Henry G. Morris in the chair, nineteen members and one visitor present.

A paper on the Comparative Anatomy of Locomotive Engines, was read by Mr. Geo. Burnham, Jr. After pointing out the analogy existing between animals and machines, both being mechanisms to perform useful work—the analogy, however, being one of function and not of form—Mr. Burnham made comparisons of similar parts in different types of locomotive engines. The change from the early form of boiler with cylindrical furnace to the present form with rectangular fire-box was explained as resulting from the necessity of increased grate area. Late variations in the form of furnace, smoke-box and other parts were mentioned, and the gradual evolution of the present flexible running gear or carrying mechanism of American locomotives, more especially the swing bolster truck, was explained.

Prof. Haupt replied to Dr. Chance's comments on the benefit to be derived from diagonal thoroughfares, showing, on his own admissions, that at "2,957 feet per diem," saved to each individual as determined by the latter, the aggregate per annum would amount to 51,328,125 miles to the traveling population as assumed by Dr. Chance. But the conclusions of the Doctor were based upon an ideal city having four times the area of that part of Philadelphia to which the original discussion was limited, and the percentages of travel were all purely hypothetical, while in the original estimate by Prof. Haupt the computations were based upon reports of passengers carried by the railway companies and distances measured on the city plan.

Dr. Chance concludes, that while diagonals "would pay, financially," and should be introduced into every proposed plan of a city, yet they would increase the density and hence be objectionable. To this Prof. Haupt answers that additional avenues, to a limited extent, would open new air air channels, admit more sunlight into the dwellings, would not practically increase the density of population, would concentrate business—enabling it to be attended to with much less loss of time and trouble—and would practically extend the radius of the city to an extent equal to the distance saved, thus enabling the populace to go that much farther into the suburbs without increase of time or expense.

In brief, both from a sanitary point of view and financially, the proposed system would be a gain to the private citizen, to the business man, to the property owner and to the city, and the original estimate of benefits to be conferred, instead of being excessive, are believed to be far below the actual results which would follow the introduction of such a system.

Mr. Rudolph Hering exhibited and explained a number of ancient and modern maps of European and Asiatic cities, showing the method of their development.

Mr. Chas. A. Ashburner, of the State Geological Survey, has adopted the Amsler's Planimeter for the estimation of the mine areas in the survey of the anthracite coal fields of Pennsylvania. He has subjected the accuracy of the instrument to a severe test. In computing areas in square inches of map surface, it was found that the maximum error was one-quarter of one per cent. In computing areas on maps of large scale the average error of the planimeter is believed to be less than either the minimum error of a careful compass survey or of an accurate plot.

HOWARD MURPHY, Secretary.

SEWER PIPE.

Even as continued danger renders men insensible to the influence of fear, so the continued freedom of a community from disease makes it neglectful of the necessity of precautionary measures, in order that the healthfulness may become permanent. Although the site upon which a town may be located has every advantage conducive to the welfare of its inhabitants, a neglect to assist and maintain these advantages by a proper sanitary system will inevitably result in a visitation of zymotic diseases. Recognizing these facts the subject of effective sewerage as the best adjunct to the preservation of health is attracting the attention not only of the authorities of large cities but those also of small towns; and in cities where thickly settled localities, formerly healthy, have been scourged by terrible epidemics, the cause has been directly traced to defective sewers—either of plan or construction.

Of necessity, cities pay much attention to this subject and endeavor by all available means to practically understand it in all its bearings, but villages and towns, both from ignorance and parsimony, let the subject severely alone. In the latter places it is the custom in the United States to place a vault designed to receive all the refuse matter from the house but a short distance from the well which supplies the people and stock with water. In nine cases out of ten the walls of these vaults are neither bricked nor stoned—unless the earth be too loose to stand alone—and, as a consequence, the soil is absolutely saturated for a radiate distance, varying according to the age of the vault, with emanations from the most loathsome substances. If the earth be gravelly, the infiltration of the fluids will sooner or later reach the well, and through the well attack the health of the inhabitants. When it is remembered that all places without drainage of any description have at least one vault for every house, and some kind of receptacle for the refuse from stock, an idea may be formed of the vital importance of removing these substances. Volumes of testimony, from the most noted physicians of both this country and Europe, and all citing cases from actual experience, have been written substantiating these facts.

Again, the vault may be so constructed that the contiguous earth will not be polluted, yet in such a case the gases arising from the decomposition of the contents of that vault will be more hurtful to health than impure water, because more widespread.

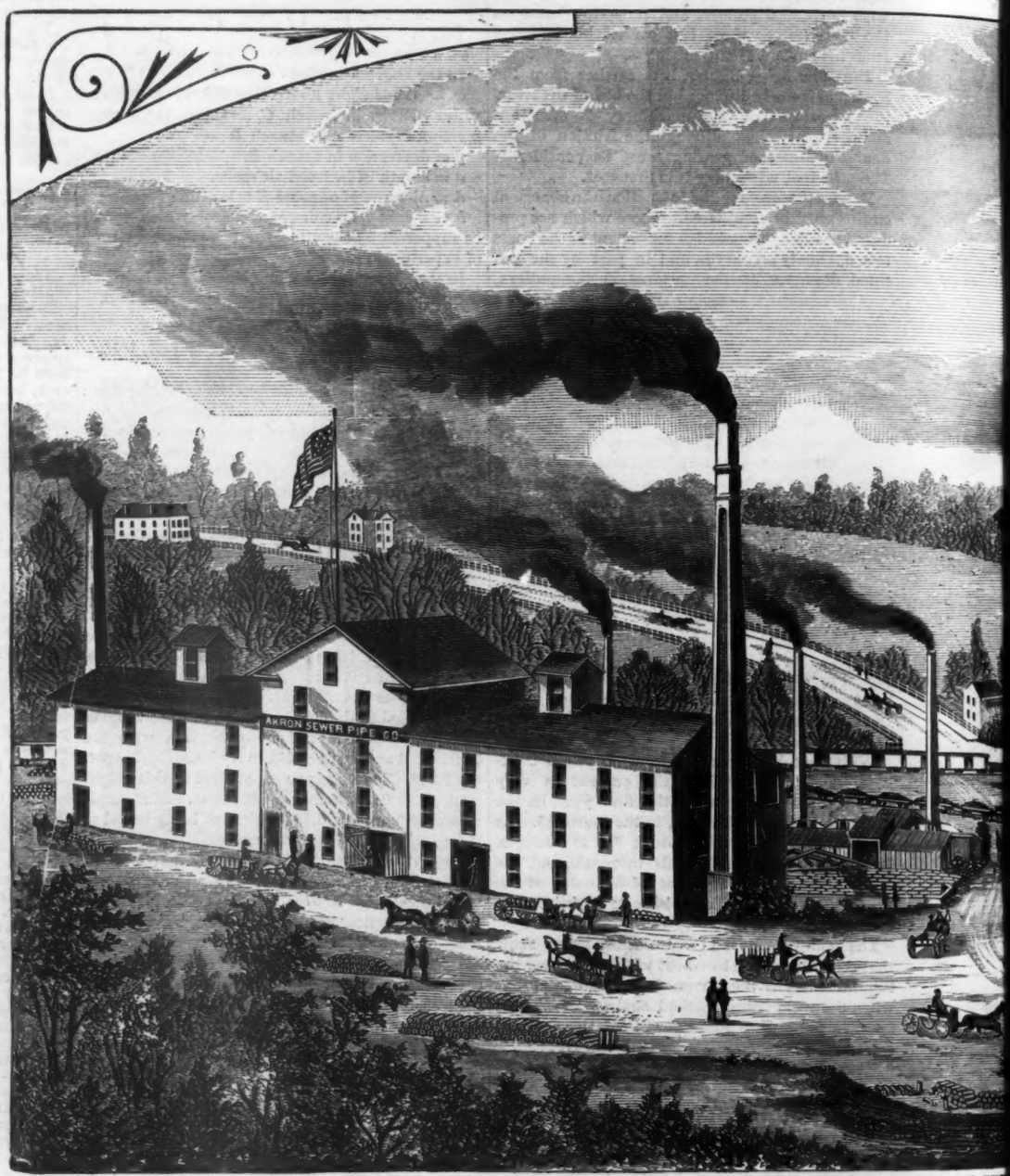
Having briefly shown the necessity of sanitary works, we now come to the question, What is an effective system of sewerage, and of what material should the sewer consist? As the first clause presents itself with an almost infinite variety of aspects, varying in accordance with the topography of each case, we will confine ourselves especially to the second.

The interior of a sewer should be as smooth and free from all excrescences as it is possible to make it, as the smallest projection will form a nucleus about which will gather sewage in quantities not only sufficient to impede the flow, but in time to block the entire conduit. Moreover, the sewage will collect above these dams and there decompose, setting free the gases which are so destructive to life. Owing to the unevenness and roughness of brick sewers, and the consequent retarding of the flow, that material is gradually but surely being relegated to the past; another disadvantage possessed by the brick is, that it is effected by the chemical action of the acids and gases, which not only act upon the mortar between the bricks, but upon the bricks themselves, producing rapid disintegration, and thereby ruining the efficacy of the work. To a certain extent, bricks are porous, and having this feature they cannot retain the poisonous gases which, in some instances, have passed through the walls of the sewer and the intervening earth to adjacent cellars, where their influence has been felt by the family. Upon this subject the English Board of Health, in a series of carefully compiled "general conclusions," said:

"That the general use of large brick sewers has resulted from ignorance or neglect; such sewers being wasteful in construction and repair, and costly through inefficient efforts to keep them free from deposits. That brick and stone house drains are false in principle and wasteful in cleaning, construction and repair. That house drains and sewers properly constructed of vitrified pipe, detain and accumulate no deposits, emit no offensive smells and require no additional supplies of water to keep them clear."

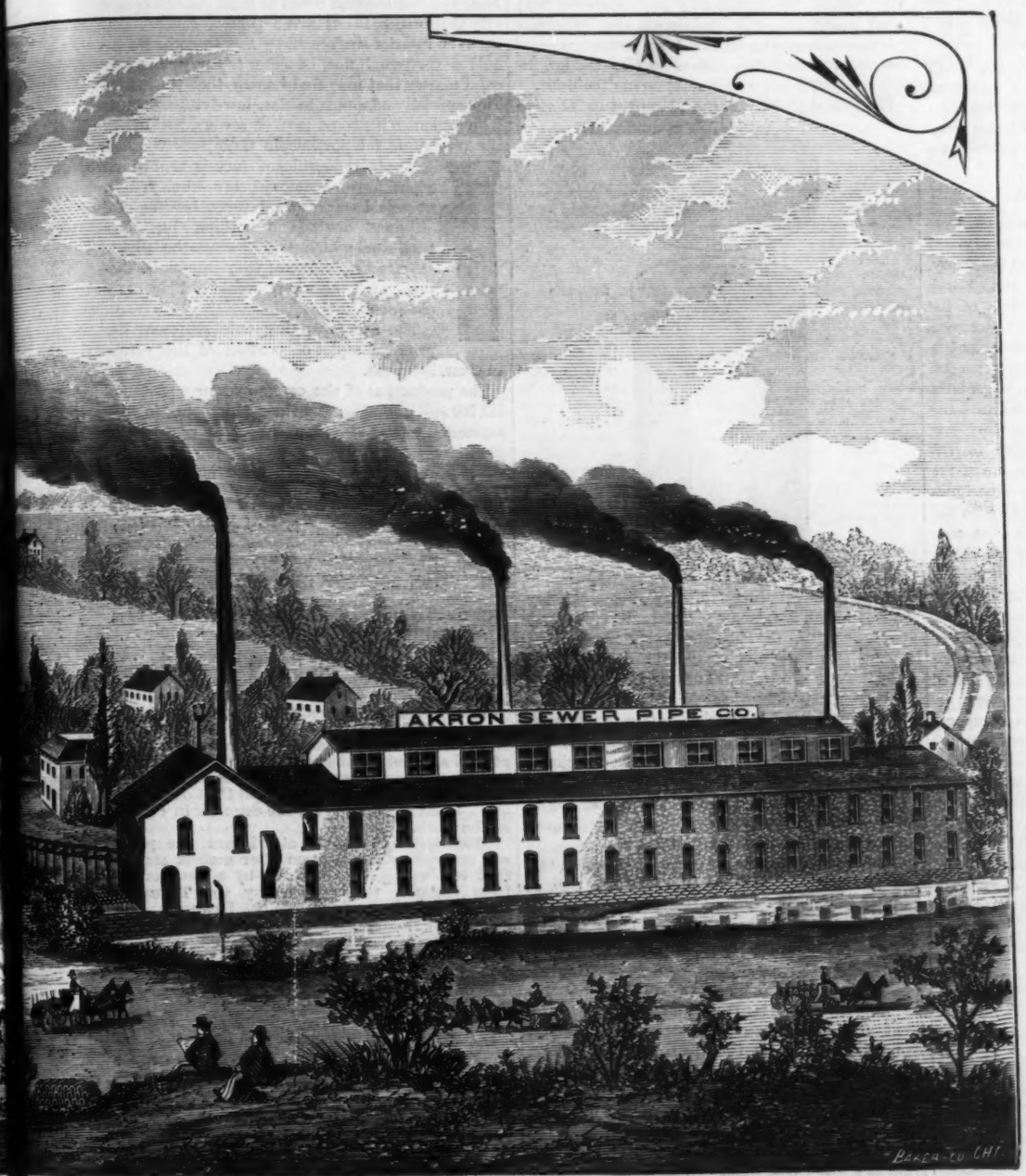
In "The Sanitary Drainage of Houses and Towns," by Col. Geo. E. Waring, Jr., we find the following remarks:

"Sewers choke and overflow during heavy storms, mainly because they are too large for the work they are ordinarily called on to perform. If a sewer is so small that its usual flow is concentrated to a sufficient depth to carry before it any



WORKS OF THE AKRON SEW

ordinary obstruction, it will keep itself clean; but if, as is almost always the case when the engineer lacks experience or when he defers to the ignorance of the local authorities it is so large that its ordinary flow is hardly more than a film, with no power even to remove sand, we may be quite sure that its refuse, solid matters, will gradually accumulate until they leave near the corner of the



PE COMPANY, AKRON, OHIO.

arch only the space needed for the smallest constant stream, and in order to make room for a rainfall flow, the sewer will have to be cleaned by the costly and offensive process of removal by manual labor. A small sewer would have been kept clean by its own flow. * * * The main sewer in Upper George street, in London, is five and one-half feet high and three and one-half feet wide. In the bottom of this sewer there was laid a twelve-inch pipe, five hundred and sixty feet long. A head wall or dam was built at the upper end of this, so that all the sewage has to pass through the pipe. The whole area drained was about forty-four acres (built area). The velocity of the water in the pipe, was found to be four and one-half times greater than on the bed of the old sewer. The pipe contained no deposit, and during rains, stones could be heard rattling through it. The force of the water issuing from the pipe kept the bottom of the old sewer perfectly clean for about twelve feet below its mouth. From this point, bricks and stones began to be deposited, and further on, sand, mud and other refuse, to the depth of several inches. In one trial a quantity of sand, bricks, stones, mud, etc., was put in the head of the pipe, the whole of this was passed clear through the pipe, and much of it was deposited on the bottom of the old sewer some distance from its end. *The pipe was rarely observed to be more than half full at its head.* It was found that the sum of the cross section of house drains delivering to this half full twelve-inch pipe, was equal to a circle thirty feet in diameter.

* * * * "Rats and vermin live and breed in large sewers—never in small pipe. * * * * *

"The pipe sewer has been so long in successful use that there is no further question of its value."

It being accepted that pipe sewers are far preferable to brick sewers, the question arises—What kind of pipe is best? There are three kinds now in the market, viz., salt-glazed vitrified clay pipe, slip-glazed clay pipe and cement pipe.

The latter is gradually disintegrated by the gases and acids with which it comes in contact, and has failed when subjected to severe tests.

The second named pipe is made from what is known as fire-clay, which retains its porosity even when subjected to the most intense heat; and although this quality renders it of value for fire-brick, it unfits it for sewer use, as it facilitates the diffusion of gases, and absorbs them in quantities sufficient to insure its own destruction. It is glazed with "slip" clay, that is liable to wear or scale off, thus leaving the porous body of the pipe open to the same objections which apply to brick.

We will confine the following remarks to the consideration of the

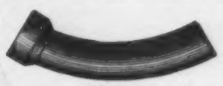
STANDARD AKRON SALT-GLAZED PIPE.

Salt-glazed pipe is a thoroughly vitrified, compact and iron-like body, formed by subjecting it to an intense heat, when it assumes its vitreous or glass-like nature, and is glazed by the vapors of salt. At a certain stage of fusion the salt is thrown into the fire, thereby creating a vapor which penetrates and unite chemically with the clay, forming an integral glazing which will not scale nor wear off, and which is absolutely impervious to the action of gases and acids. It unites with the clay so as to make a homogeneous body, which is, therefore, practically indestructible.

Y BRANCH.

Another very valuable feature of this pipe is its perfectly smooth, glassy surface. Upon this subject Col. Waring observes:

"Any roughness of surface, as in even the best made cement pipes, tends to catch hair and lint, and thus to form nuclei for accumulating obstructions, sometimes so hard that they can be removed only by forcible,



CURVE.

mechanical means. * * * The material of the pipe should be a hard, vitreous substance, not porous, since this wouldlead to the absorption of the impure contents of the drain; would have less actual strength to resist pressure; would be more affected by the frost or by the formation of crystals in connection with certain chemical combinations, or would be susceptible to the chemical action of the constituents of the sewage. * * * Much experience with cement sewer pipe seems to demonstrate that they are not sufficiently uniform in quality, nor sufficiently strong and durable to be used with confidence in any important work, whether public or private. Sewer pipes should be salt-glazed, as this requires them to be subjected to a much more intense heat than is needed for 'slip' glazing, and thus secures a harder material."

Scientific comparative tests of the different kinds of pipe have been made at Boston, Washington and Chicago. Those made at Boston were the most exhaustive, comprising the Standard Akron Salt-Glazed, the Scotch, the best Slip-Glazed, and the

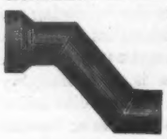
best Cement pipe, showing, all things being equal, the first-named to be superior in all material respects. At Washington, the comparison was instituted between the best Scotch and the Standard Akron Salt-Glazed. The Scotch pipe crushed into small pieces under a suspended weight of 600 pounds. The Akron pipe split like barrel staves under a suspended weight of 700 pounds.

ELBOW.

At Chicago, the test made in 1869 by Mr. W. H. Clarke, Assistant City Engineer, was on several specimens of vitrified clay pipe from different manufacturers, and was by hydrostatic internal pressure; the Akron pipe was pronounced the strongest exhibited.

AKRON SEWER PIPE COMPANY.

The Akron Sewer Pipe Works, Akron, O., were established in the year 1848, under the style of Merrill, Powers and Company, of which firm Mr. Frank Adams, now president of the corporation under notice, was a member. Though subsequently there were several changes in the firm, Mr. Adams took an active part in its business affairs until the spring of 1867, when a corporate company was organized in conformity to the State laws under the name of the Hill and Adams Sewer Pipe Company, and, as the title implies the interest of Mr. Adams was continued with the new concern. Within a year or two thereafter the name of the corporation was changed to the present title.

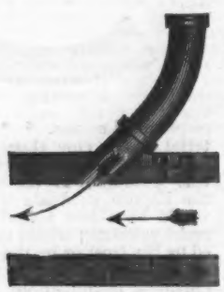

HALF TRAP.

P TRAP.

With the advantage of ample capital, and, quite as important, all the practical knowledge and skill combined that the pioneer manufacturer of clay sewer pipe in America could command, this company enjoyed at the outset such prestige and repute as afforded great promise of a most successful career. That the consummation has been a noteworthy one we further on make manifest.

SOCKET PIPE.

New and spacious buildings were erected and fully equipped with all the mechanical improvements that ripe experience had approved and patient ingenuity perfected.

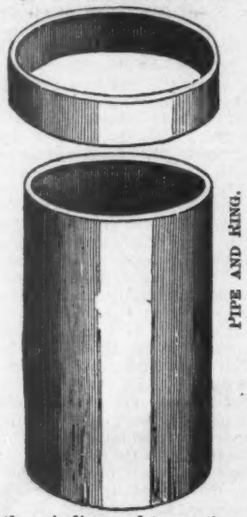

SECTION OF BRICK SEWER WITH PIPE CONNECTION.

Better and cheaper methods of preparing and compressing the clay were adopted, and in greatly improved kilns the pipes were more perfectly burned and vitrified than ever before. The popularity of the product steadily increased until the company, dating its origin from an humble beginning made a century ago, now own and operate an establishment of great magnitude and peculiar fitness for the work to be done.

These works—of which we present a truthful illustration—comprise two large factory buildings, a commodious brick office, and other structures of minor importance. One factory has ground dimensions of 180 by 50 feet, three and four stories high, the machinery in which is driven by steam and water-power combined; the other is 250 by 45 feet, two stories high, and is supplied with a 150 H. P. Corliss engine. The factories are furnished with a full complement of ponderous and expensive machinery requisite to the best performance of the work. The Valley railroad passes through the premises, affording excellent shipping facilities.

HAND HOLE TRAP.

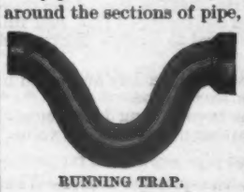
The initial process in the manufacture of vitrified pipe is the grinding and tempering of the clay, some of which is extremely "refractory," in huge mills, the substance being manipulated by large revolving disks describing diverse circles, and moving gradually from center to circumference of the clay receiver by the operation of an automatic screw. From the mills the tempered mass is thrown into the "blockers," which expel the air, solidify the substance, and form it into blocks, which are brought by elevators up to the powerful screw and steam presses. the cylinder whereof contains an inside die suspended from the top of the press, taking the place of the core in iron castings, and an outside die which forms the exterior of the pipe. The clay is forced down between these dies, producing pipe ranging in diameter from one to 24 inches, and is cut off at proper lengths by a series of knives. The present forms are then transported by steam and hydraulic elevators, consisting of endless belts, to the drying and finishing departments, where they are seasoned for three or four days by steam heaters. They are then taken by tramways to the burning kilns, ten in number, each of which is as large as a good-sized room, where for several days they are subjected to a most intense heat, sufficient to reduce iron to a cinder.


PIPE AND RING.

SLANT.

SINK PIPE.

After the clay has approached the melting or fluxing state, coarse alkaline salt is thrown upon the fires, producing a dense vapor which permeates every part of the kilns, circulating through and around the sections of pipe, completely enveloping their inner and outer surfaces. This vapor chemically unites with the pipe, communicating to it a smooth and glossy finish, whereby the substance becomes vitreous or glass-like, and the glaze is an integral part of the pipe itself; not a mere varnish-like coating, as is the case with the "slip"-glazed pipe. The contents of the kilns are allowed to gradually cool off, and usually at the expiration of a week they are in proper condition for removal and the market.


RUNNING TRAP.

The Akron Sewer Pipe has for many years been in use in every part of the country, and, judging from the testimonials received from engineers and city authorities, it has given perfect satisfaction. Its even interior surface and glassy smoothness enable a very small flow of water to carry along any solid matter that may find its way into the sewer. This specially adapts it to flat, low-lying surfaces which require the most perfect sewers, because of the very slight fall possible in their construction.

T BRANCH.

Another significant fact is that these pipes have been and are employed in chemical works and retorts, holding the strongest acids, and nothing has ever been used which will produce the slightest effect upon them; they cannot be disintegrated or even weakened by any chemical.

The accompanying cuts represent the principal styles of product of this establishment.

The production of the company now aggregates 850,000 feet annually, and their shipments in 1880 amounted to eight hundred car-loads. The staple sizes are twelve and six inches—the larger for street sewers and the smaller for house connections.

The officers of the Akron Sewer Pipe Company are Mr. Frank Adams, President; Mr. D. L. King, Secre.ary and Treasurer.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THIRTEENTH ANNUAL CONVENTION AT MONTREAL, CANADA, JUNE 15, 1881,

The first session of the Convention will be held at Montreal on Wednesday, June 15, 1881, at half-past ten a. m.

Arrangements are made to have such of the members as desire to do so meet at Niagara Falls on Saturday, June 11, and examine the new suspended structure of the railroad suspension bridge, and the reinforcement of its anchorage. A paper on this subject will be presented at the Convention by L. L. Buck, A. S. C. E., the engineer in charge of the work.

After spending Sunday at Niagara, the party will proceed to Toronto, and after a short stay at that city will go to Montreal by a steamer, on Lake Ontario, passing Tuesday the Thousand Islands and the rapids of the St. Lawrence, and arriving at Montreal the evening before the day of the opening of the Convention.

The arrangements at Montreal are in charge of a committee, and will be duly announced.

Members who cannot make the trip by way of Niagara and Toronto can go directly to Montreal, and should arrive there by June 15.

The families of members are invited to accompany them.

The general arrangements for the Convention and for travel to and from Montreal are in charge of the following committee: T. C. Clarke, W. Katté, W. G. Hamilton, J. G. Van Horne, New York; John Newell, Chicago; Charles Paine, Cleveland; F. De Funiak, Louisville; D. J. Whittemore, Milwaukee; G. Bouscaren, Cincinnati; Joseph M. Wilson, Philadelphia; Thomas J. Whitman, St. Louis; Henry B. Richardson, New Orleans; L. L. Buck, Niagara; Fred. Brooks, Boston.

Favorable arrangements for travel to and from the Convention, have been made with the railway companies.

The headquarters at Montreal will be the Windsor Hotel; at Niagara, the Cataract House. Special arrangements have been made at each.

A large attendance at this Convention is anticipated.

JOHN BOGART.
Secretary.

May 24, 1881.

AMERICAN SOCIETY OF CIVIL ENGINEERS,

127 East Twenty-third Street, New York.

THIRTEENTH ANNUAL CONVENTION, MONTREAL, CANADA, JUNE 15, 1881.

The thirteenth annual convention of the society

will be held in Montreal, Canada, beginning Wednesday, June 15, 1881, at half past ten A. M.

Sessions for professional discussion and one for the transaction of business will be held.

The general arrangements for the convention and for travel to and from Montreal are in charge of a special committee and are announced in a circular accompanying.

Details of the programme are in charge of the local committee at Montreal, of which Thomas Keefer, Esq., M. A. S. C. E., is Chairman, and John Kennedy, Esq., M. A. S. C. E., is Secretary. These details will be duly announced.

The titles of papers published in Transactions during the past year, or in preparation for publication, and upon which discussion is invited, are given below.

Members are particularly desired to take part in discussion upon any of the subjects presented, either by these papers of the past year or by new papers. Members are also requested to present papers upon other subjects.

It is important that the blank sent with this should be filled and at once returned to the Secretary, so that arrangements for the sessions of the Convention may be made in advance.

JOHN BOGART, Secretary.

May 24, 1881.

Papers published during past year:

CXC. (April.) Progress of Work at the East River Bridge: F. Collingwood.

CXCI. (May.) On the Variation Due to Orthogonal Strains in the Elastic Limit in Metals, and on its Practical Value and More Important Applications: R. H. Thurston.

CXCV. (June.) Annual Address, Engineering Progress in the United States: O. Chanute.

CXCVI. (July.) The Hudson River Tunnel: Arthur Speilmann and Charles B. Brush.

CXCVII. (July.) American Natural Cement: F. O. Norton.

CXCVIII. (July.) Notes on the South-Pass Jetties: Max E. Schmidt.

CXCIX (August.) Ship Canal Locks Calculated for Operation by Steam: Ashbel Welch.

CCI. (August.) Remarks on the Causes of Fall of the Western Arched Approach to the South Street Bridge, Philadelphia: J. G. Barnard.

CCII. (August.) Note on Kutter's Diagram: C. H. Swan.

CCIII. (September.) Tensile Tests of Cement and an Appliance for more Accurate Determinations: D. J. Whittemore.

CCIV. (September.) Waterproof Coverings: F. Collingwood.

CCV. (October.) The location of the Chimbote Tunnels: O. F. Nichols.

CCVI. (October.) Practical Consequences of Variation of the Wet Sections of Rivers under General and Special Conditions: R. E. McMath.

CCVII. (October.) Wind Pressure against Bridges: Ashbel Welch.

CCVIII. (October.) Cheap Transportation *versus* Rapid Transit and Delivery: M. Coryell.

CCIX. (October.) The Crippling Strength of Wrought Iron Columns: C. L. Gates.

CCX (November.) Web Strains in Simple Trusses, with Parallel or Inclined Booms: E. Sweet, Jr.

CCXII. (May.) Experiments with Appliances for Testing Cement: Alfred Noble.

CCXIII. (May.) Design and Construction Table for Egg shaped Sewers: C. G. Force, Jr.

CCXIV. (May.) The Preservation of Timber: J. W. Putnam.

CCXI. (November.) Discussion upon Inter-Oceanic Canal Projects; also additional Information obtained by Recent Surveys in Nicaragua: A. G. Menocal.

CCXII. (December.) The Strength of Wrought Iron Columns: G. Bouscaren.

CCXIII. (December.) The Improvement of the Harbor of Quebec: J. Vincent Browne.

CCXIV. (January, 1881.) The Strongest of the Bronzes; a newly discovered Alloy of Maximum Strength: R. H. Thurston.

CCXV. (January, 1881.) Renewal of Foundation and Transfer of a Lighthouse in Pascagoula Harbor: J. W. Putnam.

CCXVI. (February, 1881.) The Sewerage of Memphis: F. S. Odell.

CCXVII. (March, 1881.) On the Ventilation of Halls of Audience: Robert Briggs.

CCXVIII. (April, 1881.) The Construction of the Second Avenue Line of the Metropolitan Elevated Railroad of New York: G. Thomas Hall.

CCXIX. (April, 1881.) Exponent of the Principle of Moments: W. S. Auchincloss.

CCXX. (May, 1881.) Wind Pressure upon Bridges: C. Shaler Smith.

CCXXI. (May, 1881.) An Examination into the Methods of Determining Wind Pressures: F. Collingwood.

———The Removal of the Egyptian Obelisk from its site in Alexandria, Egypt, to its site in the Central Park, New York City: Henry H. Gorringe.

———Quicksand in Excavation: Charles L. McAlpine. (Advance slips printed.)

The following papers are announced for presentation during the Convention:

Re-enforcement of the Anchorage and Renewal of the Suspended Structure of the Niagara Railroad Suspension Bridge: L. L. Buck.

The Stability of Tunnels in River Silt: Ashbel Welch.

Repairs of Masonry: O. Chanute.

Experiments upon Strength of Wrought-iron Columns: T. C. Clarke.

On Weights and Measures: Charles Latimer.

Comparative Economy of Light and Heavy Rails: Ashbel Welch.

EXPERIMENTS WITH LUMINOUS PAINT.

Dr. Morton delivered a lecture before the New York Academy of Sciences on the evening of the 23d on optical phosphorescence. The lecture was accompanied by some curious experiments with sulphide of calcium paint. Dr. Morton said that while heat, to become luminous, must be made very intense, phosphorus emits light with very little heat. Phosphorescence is a purely chemical action, but there is a class of phosphorescents that do not depend on chemical action. The means of producing light are both mechanical and chemical. Thus the blacksmith as he strikes the iron produces first the long heat waves, the vibrations growing gradually shorter until a white heat results. But the long waves continue to vibrate at the same time with the shorter light ripples. With phosphorus the higher wavelets can be produced without beginning with the long waves. Sulphate of quinine and other substances have the power of taking short rays, while they emit longer waves. They do not store up the light, but emit it in 1-500th part of a second. Phosphorescent bodies do not act in so short spaces, but re-emit a somewhat larger wave. Bodies have been manufactured which will continue the emission for a very long time. When light falls on phosphorescent bodies it effects a molecular change and thus stores up energy. When the light is emitted the molecules fall back into their natural place and develop energy also. In the case of sulphide of calcium heat is the agent that develops this energy. It is made by heating sulphur and lime together. It has been so improved in manufacture that it now emits light for hours.

Dr. Morton then exhibited a plate of glass painted over with sulphide of calcium, the hall being darkened for the purpose. It gave a very clear, blueish light. He said that a window thus coated would light up a room sufficiently during the night, while it would be transparent during the day. A painted lantern was shown which could be taken round without any need to recur to matches. A star cut out of pasteboard on a canvas coated with the paint appeared perfectly black, while the canvas gave forth the peculiar blueish white light. A tin globe painted with the sulphide and magical signboards which gave out the letters on them or exposed a dazzling white surface, according as the room was darkened or not, excited the admiration of the audience. A bust, the hair and toga of which were painted, while the face and breast were not, was very pretty, the face and breast being yellow, gradually getting darker, while the robe was dazzling white. Dr. Morton said he could make his way through a dark cellar easily by its aid. There is, of course, no danger of fire. He said he looked forward to the time when the use of sulphide of calcium would obviate a great many dangers to which miners and others are exposed.

GEO. STEPHENSON'S CENTENARY.

On the 9th of June the centenary of the birth of George Stephenson will be celebrated at Chesterfield, England. The birthplace of the father of our railway system was in the Northumbrian village of Wylam; but Chesterfield was his chosen home, where he passed many years' and lived to the last happy among his dogs, his rabbits and his birds, and, when not engaged about the works of his collieries, very busy in the favorite pursuits of his later life—horticulture and farming. Stephenson died in 1848, and his body was deposited in Trinity Church in that town.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

Efforts for a better water supply are being made at Dover, N. H., and the city government advises immediate action.

Messrs. Laidlaw & Son, a Glasgow firm, has been awarded the contract for the construction of waterworks at Winnepeg.

The controversy between Mr. Geo. H. Corliss and the city of Boston about pumping engines is to be reported fully in print by the City Council.

The town of Manson, Iowa, is trying to get a water supply by sinking an artesian well. The pipe has been driven 900 feet, to rock, and no water yet.

The Governor of New York has signed the bill amending the act relating to the creation and formation of water-works companies in towns and villages of this State.

Citizens propose that New Haven, Conn., shall buy the water-works from the private water company for $2,000,000, but there is strong opposition to shouldering so great a debt.

At the annual meeting of the Turners Falls, Mass., fire district, a committee was chosen to investigate the matter of giving the village a better supply of water for fire and domestic purposes.

Some of the citizens of Gloucester, N. J., thinking that the City Council is not following the law strictly in the preliminary arrangements for the erection of waterworks, talk of blocking the whole business by an injunction.

The committee of the Chester (Pa.) City Council appointed to ascertain the terms upon which that city could obtain control of the water-works has reported, advising that no step be taken at present to obtain control of the works.

Water-works in Chicago is becoming more of a *bore* than usual. Mayor Harrison, when asked the other day by a reporter what he thought of the report made by the Committee of the Legislature in regard to the Bridgeport Pumping-works, replied, sardonically, "I am tired of being pumped on pumps."

CHICAGO, May 16.—The City Council to-night adopted a resolution asking the State Legislature to take action toward securing a constitutional amendment which will allow the city to issue as high as $5,000,000 in water funds, to secure new water-works which shall not be subject to contamination from the city sewerage.

The Hyde Park, Ill., Water-works are to be located on the lake shore at Sixty-eighth street. There being no elevation suitable for a reservoir, the "direct supply" is the only one that can be depended on. Cost will be about $95,000. Engineer Cole will advertise for bids on a pump of 5,000,000 gallon power and nine miles of 16-inch pipe.

COUNCIL BLUFFS, Ia., May 21.—The Hon. J. R. Reed, of the District Court, to-day refused to grant an injunction asked for by nine citizens restraining the American Construction Company from erecting water-works in this city. His opinion was lengthy and learned. The company states that it will now proceed at once to construct the works.

The Holly Manufacturing Company have received the contract for the machinery, pipes, hydrants, engine house, impounding reservoir, etc., for the proposed city water-works for Salem, N. J. Contract price about $75,000. Work to commence at once and to be completed during the coming fall. The works will be owned and operated by the city. Isaac S. Cassin, of Philadelphia, is consulting engineer for the city.

At a large fire in Cleveland, O., on Monday evening last, the utmost inconvenience and danger was experienced from the lack of sufficient water. The first two engines soon exhausted every available drop in the Carter street water-pipe, which is altogether too small for the locality, and then the firemen were obliged to pump entirely from the river several hundred feet distant. This required the placing of engines at a great distance from the fire, to the destruction of considerable hose. Fire Commissioner Gloyd, who was present, "took in" the condition of the water supply, and will report its scarcity with a request for an improvement.

The Hyde Park (Ill.) water-works having been recently sold to the adjacent town of Lake, the village will have about sixteen months in which to erect new works and lay a portion of the water-pipe circuit. Considering the short time in which to do the necessary work, it is necessary that it should be under way at once. The Board will arrange for a pumping engine which will furnish not less than 5,000,000 gallons of water per day, and when it is known that the proposed works will be obliged to give water to the present territory and, in addition, to Colehour, Pullman, Kensington, Irondale, South Chicago and Grand Crossing, it is thought that even this capacity will be hardly enough. A part of the proposed work will include the purchase and laying of one mile of pipe twenty-four inches diameter, one mile twenty inches diameter, and one mile sixteen inches diameter.

At a meeting of the City Council of Boston on the 17th a communication was received from the water board, asking authority to proceed at once to the construction of an additional storage basin in connection with the Sudbury River water supply, designated in the preliminary report of 1872 as basin No. 4. The basin, the proposed location of which is on Cold Spring Brook, will contain about 1,100,000,000 gallons, and will add about 5,000,000 gallons a day to the supply in a dry year. The dam, which it will be necessary to build, will be about 2,000 feet long, and the flowage area, with marginal land, 250 acres. Estimated cost, exclusive of land, $354,000. The greater part of the land to be flowed has been bonded by the board, and its estimated value is not far from $26,000. Furthermore, the board suggests that, out of the appropriation for additional supply, there is, at present, an available balance of $70,169.69, which can be applied to the cost of the new structure, and, in conclusion, asks for authority to build the foundation of the proposed dam by day labor. On motion of Alderman Caldwell, the communication was referred to the committee on water.

The National Meter Company, John C. Kelley, President, has just achieved another mechanical success in the completion and shipment to-day of a ten-inch water meter, the second of that size ever manufactured. The

apparatus is intended, and was made expressly for the corporation of St. Gabriel village, a prosperous manufacturing center near Montreal, Canada. Several years ago the National Meter Company furnished a meter of this size to the city of Montreal, and it gave so much satisfaction that there was no difficulty in obtaining the order from St. Gabriel when the time for using the appliance arrived. As a piece of mechanical ingenuity it is a pronounced success, and some idea of its capacity may be formed from the fact that the highest index on its dial registers up to one thousand million feet. The National Meter Company, which is a distinctively Brooklyn institution, seems to be driving things at full pressure in both their foundry and machine shops. Their Crown Meter is being rapidly introduced in all the principal cities and towns of the United States and Dominion of Canada, Providence, R. I., Meriden, Conn., Cincinnati, Ohio, Waco, Tex., and St. Jean Baptiste, Can., being the latest to approve and use it. The city of Providence has the largest number of meters in use of any city in the country.—*Brooklyn Times, 24th.*

STREETS, DRAINAGE, ETC.

On the 31st a vote is to be taken in Burlington, N. J., on the expediency of issuing city bonds to the amount of $12,000 for drainage purposes.

The New York Legislature has passed the bill authorizing the city of Buffalo to issue bonds to the amount of $1,837,500 for the construction of a sewer.

The N. Y. State Legislature has passed the bill to authorize the City of Elmira to establish a sewerage sytem, and to provide the means therefor.

The board of commissioners of Delphi, Ind., in special session last week voted to construct twenty-one miles more of gravel road. A road of nine miles is already under process of construction.

The town of Enfield finds no economy in tarring its bridges, having rebuilt one, and another is not considered safe for heavy travel. The tar forms an outside shell that looks well, but underneath is dry rot. Nearly all the roofs that were tarred in 1871-2 have been reshingled.

BRIDGES.

The N. Y. Legislature has passed the bill incorporating the Niagara Bridge Company, and for a bridge in Onondaga.

The Governor of New York State has approved Bill No. 313, amending act providing for the incorporation of bridge companies.

The Corrugated Metal Company of East Berlin will build the bridge over the Mad and Naugatuck rivers at Waterbury for $18,900.

EL DORADO, O., May 10.—While Charles Vaggle and his team were crossing the bridge with a load of hogs, the bridge gave way, and all were dropped down an embankment of twenty feet, killing the driver and both horses.

The Hubbard, Ohio, Council interviewed the commissioners of Trumbull County in the interest of bridges Tuesday last. The commissioners have decided to put a twenty-four-foot span bridge at Hirst's old mill at Coalburg, Trumbull County.

Mr. C. Shaler Smith, of the Baltimore Bridge Company, is just finishing ten spans of iron bridges on the Atchison, Topeka & Santa Fe Railway and twelve spans on the Gulf, Colorado & Santa Fe Railroad, which will let that company into Fort Worth, Texas. He is also putting in two viaducts on the Gunnison extension of the D. &. R. G. Railway.

A twenty-foot span bridge over a small stream below Bolton, in Preble County, O., that had been condemned by the inspector and pronounced unsafe, broke in two while a traction engine manned by John Marshall, of Dartown, O., and his helper, was crossing it. The engine, tank, coal-wagon and bridge dropped in a pile into the stream, and the men were buried under it. Both were horribly burned and scalded. It was an hour after help arrived before they could be extricated.

RICHMOND, Ind., May 20.—Samuel Henderson, one of the men who went through Bolton Bridge, near Fairhaven, with a traction engine, and who was so badly burned and scalded by the hot boiler and escaping steam, died on the way home. His partner, John Marshall, will probably die of his injuries. Two lives were lost, and a third death will probably result from accidents by rotten bridges within ten miles of the city that day.

THE RANDOLPH STREET (CHICAGO) VIADUCT.—The west approach begins near the east line of Michigan avenue, and is 289 feet long, with a grade of 5 $\frac{15}{100}$ ft. per 100 ft., and wide enough to accommodate a large traffic. It is built of cut stone, and will be surmounted by a paneled pedestal and parapet. Extending from the west to the east approach will be twenty-eight spans, the length of which are as follows: First and second, 53 feet 7½ inches each; third, 74 feet; fourth and fifth, 68 feet 4 inches each; sixth, 66 feet; seventh, 61; eighth and ninth, 72 each; tenth and eleventh, 65 each; twelfth, 54; thirteenth, 56 feet 6 inches; fourteenth, 80 feet; fifteenth, 67 feet 6 inches; sixteenth and seventeenth, 65 feet each; eighteenth, 70; nineteenth, 80; twentieth, 60; twenty-first, 50; the remaining spans, 25 ft. each. The superstructure will be supported on iron posts, resting on stone piers, built on piles. It is known as the Warren girder, and is 8 ft. 6 in. high. The height of the viaduct above the railroad tracks will be 19 ft. in the clear. The width of the roadway from the centre of trusses will be 21 ft. 8 in.; the whole width, 30 ft. The east approach is 360 ft. long, of ample width, with a grade of 4 $\frac{73}{100}$ ft. per 100 ft. It will be built of dimension stone, with a suitable coping, surmounted by an iron railing. The west approach will be made very attractive by the erection of six ornamental lamp-posts. On the viaduct lamp-posts will be erected at every other span. The total length of the viaduct will be a trifle less than 1,725 ft. The estimated cost is $100,000.

RAILROADS.

Wrought-iron turntables, built at Indianapolis, are taking the place of cast-iron turntables, built at Philadelphia, at several important points on the Baltimore & Ohio road.

The Chicago & Rock Island Railroad is, it is announced, going to build a branch from its main line in Iowa to the Northern Pacific. Such a branch to the Northwest would alter the relations of the entire "Iowa system," and be the beginning of a railroad war of the first magnitude.

There are now 20 lines of railway under course of construction in the republic of Mexico, besides some 20 more projected on paper. Some of these roads, like the Mexican Central and the Laredo lines, are from 800 to 1,200 miles in length. Others are mere branches, some of them but a few miles in length. The government has already paid out for subsidies over $12,000,000.

Work on the Sunflower extension of the Greenville, Columbus & Birmingham Railroad is being pushed forward with great zeal. The road has now in operation and in course of construction forty miles, and it is expected to add to this forty miles more by the first of December next. This road is designed to, and will eventually, control the business of the rich cotton region known as the Yazoo Delta.

The St. Louis & Texas Railroad, of Arkansas, was organized in Little Rock May 20. President, J. W. Paramore, St. Louis. The road is to be built by September, 1882. George B. Hibbard, of St. Louis, has got the contract for its construction. Work will begin immediately. Four corps of engineers are in the field. The road runs through Arkansas midway between the Iron Mountain Railroad and the Mississippi River. Mr. Paramore is also President of the Texas & St. Louis Narrow-Gauge Railroad Company.

The Texas & St. Louis Narrow-Gauge Railroad Company has closed a contract for 10,000 tons of English steel rails for the road between Texarkana and Cairo, at $61.50 per ton. Two thousand tons are to be delivered monthly. Colonel J. W. Paramore, President of the Texas & St. Louis, is now in New York perfecting the organization of the company, which will construct and control the Arkansas & Missouri Division, but it will be operated by the Texas & St. Louis. Four hundred miles of this line will be completed one year from next September.

The endless cables of the Chicago Street Railway Company will be in operation on State Street in July, or by the middle of August. Wabash Avenue will next be supplied with the new motive power. Both these streets will be laid with granite blocks.

The company begins at once the erection of the buildings needed for the machinery. The south half of the building on Twenty-first and State streets will have to be torn down, and another erected, to contain the four 250 horse-power engines and boilers, and the drums, winders, and cables furnishing the motive power for the cars.

It will be remembered that by the terms of the C. P. R. contract the Dominion government undertakes to build the section of railroad from Yale to Port Moody, a distance of 85 miles, and then present it to the St. Paul Syndicate. Mr. Marcus Smith, C. E., Deputy Engineer in Chief of the Canada Pacific Railway, left Toronto by the noon train of the Grand Trunk Railroad on the 23d, en route to British Columba, via San Francisco. He will sail from the latter port for Victoria on May 30. Mr. C. H. Gamsby accompanies him as chief assistant, and Mr. Bonaidale as secretary. The rest of the party will be made up in British Columbia. As soon as the survey from the terminus of Onderdonk's contract at Yale to Port Moody has been completed it is expected the construction will be immediately commenced.—*Toronto Globe.*

That work on the Northern Pacific Railroad is being pushed ahead as rapidly as possible is shown by the fact that there are no less than fourteen surveying parties in the field at the present time. The engineering force now includes Engineer-in-Chief Gen. A. Anderson, with a corps of thirteen, at the headquarters at Brainerd; Capt. Merritt, in charge of the work in St. Paul, with three men; Engineer Weeks, on the Wisconsin Division east of Duluth, with three parties, consisting of fifty-five men; Engineer Crandall, on the Fargo & Southwestern Branch, with eight men; Engineer Bunsenwein, on the Little Missouri River, with five men; Engineer Fuller, at Mandan, with four men; Engineer Clough, along the Yellowstone River, having five parties, consisting of sixty men; Engineer Dodge, on the Rocky Mountain Division, has his headquarters at Butte City, and has fifty men in position, one party being at Bozeman, one on Little Blackfoot Creek, and one on Clark's Fork; Engineer Morrison, with seven men, is in charge of the bridge work at the Missouri River crossing, with his headquarters at Bismarck. The total of men engaged on engineering work is 302. If within the bounds of human possibility, the railroad will this year be completed to Pompey's Pillar on the Yellowstone River, which point is 200 miles west of Glendive and forty miles east of the little settlement called Coulson's City. If this be accomplished, 240 miles of road will virtually have been constructed since work began this spring. A portion of the Rocky Mountain Division has been decided upon, from the mouth of Little Blackfoot Creek to the Town of Missoula.

NEW PROJECTS.

It has been decided to extend the Danville, Olney & Ohio Railroad (at present an unimportant road running from Kansas, Ill., to Westfield) northward from Kansas, to connect with Chicago and Eastern Illinois at Danville, and southward to intersect the Ohio & Mississippi at Noble, Ill. The road was originally a narrow-gauge, but is now being widened, and when completed will furnish another Illinois outlet from Chicago.

Work was commenced on the Laclede and Fort Scott road, fourteen miles west of Lebanon, May 18.

The Milwaukee Grain Transportation Company, with $1,000,000 capital stock, and Thos. K. Ewing, Sam McCord and W. H. Osborne as incorporators, filed articles of association in Madison, Wis., May 17. The purpose is to manufacture and sell cylinder railway cars under a patent held by the Prosser Twin Cylinder Car Company of Chicago.

The stockholders of the Cincinnati, Indianapolis, St. Louis & Chicago Railroad have decided to raise the capital stock of the company from $4,000,000 to $6,000,000, the additional capital to be used in building the extension from Kankakee to Seneca, Ill., forming a connection with the Rock Island & Pacific at the latter point. A direct line will thus be secured from Cincinnati to Omaha, Kansas City and other Missouri River points.

The Wisconsin Central road has concluded to let the Northern Pacific build a connection of seventy miles from Duluth to the vicinity of Ashland.

The shareholders of the Rochester & Pittsburgh Railway have resolved to increase their capital stock from $3,000,000 to $4,000,000, in order to extend lines and erect depots.

The Chicago Underground Electric Company, with a capital of $1,000,000, has received a State charter. The object of the company is to operate in Chicago underground channels for telegraph, telephone, electric light and fire alarm wires, and for pneumatic tubes for conveying packages.

CONTRACTING, MISCELLANEOUS, ETC.

Quebec is to have a great hotel of the modern type at a cost of $500,000. The Princess Louise is a large stockholder in the company that is building it.

Major G. J. Lydecker, United States Engineer, last week opened bids for furnishing 12,500 cords of stone for the 2,500 feet of breakwater which is to be built in Chicago Harbor. The following bids were received: Chicago & Lemont Stone Company, $8.95 per cord; Gysbert De Clerq, $9.50; Excelsior Stone Company, $10.50; Enterprise Stone Company, $11.50; George Turner & Co., $12.25. The lowest bid was recommended for acceptance.

Some forty miles of the grading of the extension of the Indiana, Bloomington & Western road, from Indianapolis to Springfield, has been put under contract within the last week, and large forces of men and teams will be set at work in this county and in Henry County; Chief Engineer Moore has the line located to suit him, and the work of construction is now to be pushed vigorously. By June 1 it is proposed to have 2,000 men and 300 teams engaged in the grading.—*Indianapolis Journal.*

The contract for fifty-five miles of the Wabash road from Des Moines to Albia was let on the 18th.

The resolutions passed by the Milwaukee, Lake Shore & Western Railway Company, at its recent meeting, outline the extensions determined on. The first extension is from Two Rivers northward to Sturgeon Bay, a distance of fifty miles; the second extension (main line) is from the present terminus at Antigo eastward to the Wisconsin River, a distance of fifteen miles; the third extension is from Antigo to Florence, in Marinette County, near the Michigan line, a distance of forty-three miles. The Milwaukee and Northern Company proposes to extend its line from Green Bay to Quinelles, which, with the Lake Shore completed to Florence, will compete with the Chicago & Northwestern for the immense iron-carrying trade of Northern Michigan.

Iowa City will soon have a new City Hall, to cost $10,000, and a charter has been granted for a new street railway.

Grading will commence on the Wisconsin Division of the Northern Pacific Railroad on June 5. Work is in progress on the branch from Fargo in a southwesterly direction, and the Casselton branch is being extended. The grading of the eastern approach to the Bismarck bridge will begin next week; the masonry and superstructure work is proceeding vigorously. The Missouri Division was completed last fall to about forty-two miles from the Yellowstone; track-laying is going on 1½ miles per day, and the Yellowstone will be reached at Glendine by the middle of June. Large forces of men and teams are at work on the Yellowstoue Division, and Miles City, about eighty miles up the Yellowstone, will be reached by July 31. Four surveying parties are at work in the Rocky Mountains Division. Engineers are locating the line of the Clark's Fork Division, and grading has been commenced on the eastern end. The line around Lake Pend d'Oreille has been economically improved, and the graders are at work. The track has been laid 134 miles from Wallula on the Pend d'Oreille Division. On the Cascade Division in Washington Territory a more favorable line than heretofore reported has been found, and surveys are in progress between Kalenna and Portland on both sides of the river.